

SCIENTIFIC AMERICAN

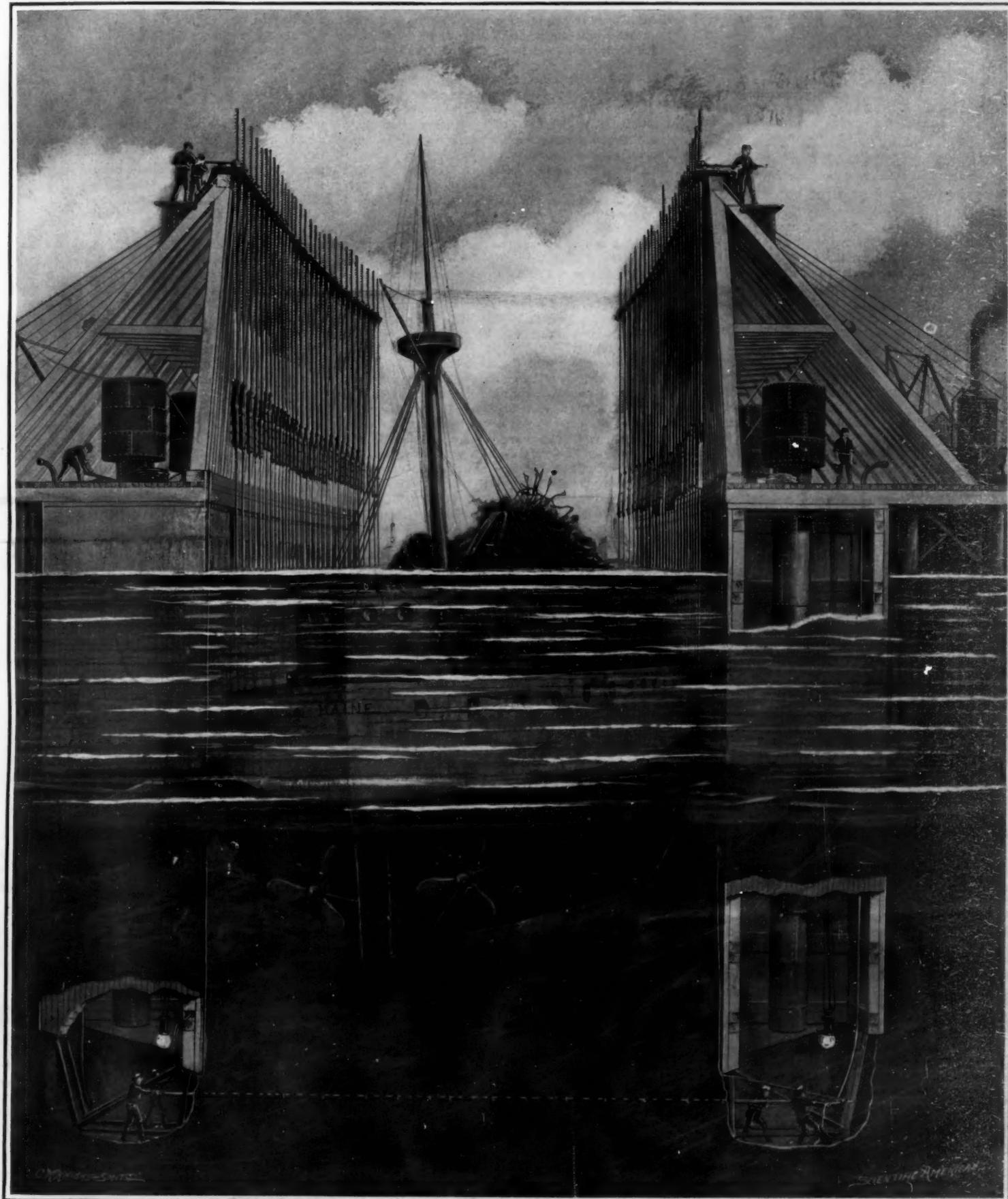
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A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

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The above plan, proposed to the War Department, contemplates sinking a line of caissons along each side of the "Maine" and lifting the ship by means of large steel cables slung beneath the hull and hoisted by screw jacks attached to the caissons.

RAISING THE "MAINE."—[See page 142.]

ENGINEERING.

Statues and other memorials to civil engineers are all too scarce. Hence we record with particular pleasure the recent unveiling in the magnificent Pennsylvania terminal station, Manhattan, of a memorial to A. J. Cassatt. This bronze statue, which is of heroic size, and stands above the stairway leading from the concourse of the station to the general waiting room, records the fact that it was Mr. Cassatt "whose foresight, courage and ability achieved the extension of the Pennsylvania system into New York city."

There has recently been completed by Messrs. Vickers Sons & Maxim a 22,000-ton floating dock for the use of the Brazilian government, and more particularly for the accommodation of the three Brazilian dreadnaughts. It is the largest of its kind that has yet been built in Great Britain, the length over all being 550 feet 6 inches; the width, 126 feet; the length of the side walls, 450 feet 6 inches; the depth of pontoons at center, 18 feet 3 inches, and the height of the side walls above pontoons, 45 feet 6 inches.

Actual work has commenced at the Eagle dam site of the Rio Grande irrigation project, New Mexico. The United States came into possession of the reservoir and surrounding land on July 4th, and about fifty men, which is as many as can be profitably employed until work on the railroad is let, are now employed on piers for bridges, roads, etc. The unusual dry weather is now being felt in Mexico, and farmers are anxious for the completion of the work, as it will forever banish the fear of droughts on the land which will be included in the project.

By the completion of a connection between the Chicago drainage canal and the old Illinois and Michigan canal near Joliet, Illinois, barge navigation has been rendered possible between Lake Michigan and the Mississippi River. The route is by way of the Chicago drainage canal, to Joliet, the improved Illinois and Michigan Central canal from Joliet to the Illinois River, and by the latter waterway to the Mississippi. Barges 80 feet long, 16 feet wide, drawing four feet, and carrying 200 tons, can now be operated between Chicago and Mississippi River points.

The Eighteenth National Irrigation Congress will be held this year in Pueblo, Colorado, from September 26th to 30th. It will be the greatest gathering in the history of irrigation development in the West, many thousand accredited delegates being present. There will be an exposition of machines and appliances for the development of power in irrigation and drainage work; of methods and devices for the transmission of this power; of machinery for raising surface and ground water for irrigation and drainage and distributing the same; and for the economical cultivation of the land so reclaimed.

Congress appropriated for the American navy for the fiscal year 1911 a total sum of \$131,350,854, which is \$5,500,000 less than was voted last year. The bill provides for two first-class battleships, whose cost, exclusive of armor and armament, is not to exceed for each vessel six million dollars. Provision is also made for six torpedo boat destroyers costing \$750,000 each; two 14-knot colliers, each to carry 12,500 tons of coal, exclusive of bunker coal, and to cost \$1,000,000, and four submarines to cost each \$500,000. There is also an appropriation of \$445,000 for the construction of a torpedo vessel of an experimental character.

The Soo Canals are the busiest artificial waterways in the world, and the traffic grows apace. The last report of Col. C. McD. Townsend of the U. S. Army Corps of Engineers, shows that the total value of freight passing through the canals during the season of 1909 was \$626,104,173. The total freight traffic for the year amounted to 57,895,149 net tons, an increase of no less than 40 per cent over the amount in 1908. The average number of vessels per day through the Poe lock of the American Canal was thirty-five. Through the Weitzel lock of the same canal it was twenty-two, and through the Canadian lock, twenty-seven per day. The whole of this immense traffic was confined to a season of navigation of seven months and twenty-seven days.

At a recent meeting of the Concrete Institute of London, held at the United Service Institution, Mr. E. R. Matthews, in a paper on "Reinforced Concrete Chimney Construction," stated that during the past seven years one American firm alone, of Chicago, has erected nearly a thousand concrete chimneys in America. The advantages were found to be: that the cost is one-half as much as a brick shaft; there is a saving in space; there is an economy of materials; the brick work at the base of a 300-foot shaft measuring about 4 feet 10 inches, while a concrete shaft of the same height would have an outer 9-inch wall, and inner 5-inch with a 4-inch space between. A concrete shaft weighs less; has sufficient stability, there having been but one failure recorded due to faulty construction; it can be built in one-half the time required for a brick shaft; and, once constructed, the concrete shaft requires practically no repairs.

ELECTRICITY.

Efforts are being made in England to require that all passenger-carrying British and foreign vessels sailing from British ports should be equipped with wireless telegraph apparatus capable of transmitting to a distance of one hundred miles. A bill to this effect now before the House of Commons provides a penalty of \$5,000 in case of failure to obey the law.

The Bureau of Statistics of the Department of Commerce and Labor reports that while the exports of electrical appliances and machinery for June of this year were higher than for the corresponding month last year, they fell behind the month of May, 1910, by a considerable figure. The actual value of the exports was, in May, \$1,710,487, and for June \$1,488,795, while for June of last year it was \$1,262,497.

It has been pointed out that Japan is an ideal country for hydro-electric development because of its many rapidly-flowing rivers. However, there are difficulties in the way of such development, not the least of which is the danger of earthquakes. Recently, it was proposed to build a large dam to furnish power for a generating plant of huge proportions, but fearing lest there might be a break in the dam caused by one of the earthquakes so frequently experienced in that region, it was decided to abandon the project.

A new system of paging guests has been introduced in Chicago. Instead of having a boy go through the hotel calling the name of the one wanted, automatic enunciators are provided in various parts of the building, which consist of loud speaking receivers capable of being operated from a central station in the hotel. Forty receivers may be operated by a single transmitter, and this number may be increased by the use of repeaters. The apparatus was tested in a hall containing 7,000 people, and could be heard perfectly clear throughout the hall.

According to a recent Consular report, wireless telegraphy is being introduced among German fishing vessels. The advantage of this system of communication is that it permits one vessel that is making a good catch to report the matter to another vessel of the same company, so that the entire fleet may return with the largest possible quantities of fish. Furthermore, they can inform the managers of the public markets respecting the quantities of fish they have for sale, so that in case of an unusual catch, arrangements may be made for distributing the fish in the least possible time.

It has recently been reported that a large electric power plant is to be established in the coal fields on the bank of the Rio Grande near Laredo, Texas. At the outset the plant will furnish 50,000 horsepower, and provision will be made for increasing its capacity according to demands. This plant will furnish power for Laredo, Carrizo Springs, and Monterey, and Lampagos, Mexico, as well as a number of other smaller towns and cities. The power will also be used for irrigation along the upper valley of the Rio Grande. The railroad, which is to be extended to the coal fields, will be electrified. The plant will be very economically operated by using the coal screenings.

A writer in the Electrical World recently pointed out that in sorting glow lamps according to wattage and candle power by the customary methods, there is a considerable expenditure of time involved, as each lamp has to be treated individually. He has, therefore, suggested using the relations between the pressure, candle power and specific consumption of any class of filament. He has worked out a graphical chart showing the relation between these quantities, and by observing these curves, it can readily be determined what pressure and approximate candle power can safely be assigned to any individual lamp in order that a certain specific consumption may be attained.

The transmission of wireless messages through the crust of the earth is the latest development of radio-telegraphy, thus confirming the original theory of wireless telegraphy advanced by Salva, a Spanish physicist, in 1795, in the suggestion that it might be possible to charge the earth at Majorca with positive electricity and that at Alicante with negative electricity, when the attraction of the opposite charge would establish communication between the two cities. The exchange of the wireless signals through the earth has been made by two German physicists, who, with the permission of the royal mining authorities, have made a series of trials of radio-telegraphy at the Diennenburg potash mine and have succeeded in exchanging long distance signals with simple instruments. According to the latest announcement, Drs. Loewe and Leimbach, the German savants, who accomplished this radio wireless feat, are satisfied that it would be possible to penetrate to even greater depths through the crust of the earth.

AERONAUTICS.

Mr. J. Armstrong Drexel, the young American who has been making record flights in England with a Blériot monoplane, on the 11th instant, broke the world's record for height by reaching an altitude of 6,750 feet. This is 575 feet higher than the altitude reached by Walter Brookins with his Wright biplane at Atlantic City last month.

The opening day of the meet at Asbury Park, N. J.—August 10th—was marred by an accident to Walter Brookins. After making a splendid flight in a stiff wind of over 20 miles an hour velocity, Brookins attempted to descend upon the field, but seeing some photographers sprinkled about, in an effort to avoid landing upon them he brought his machine near the grand stand and attempted to rise again. The wind caught him and drove his machine to the ground head-on. The biplane struck in an alley at one end of the grand stand and half a score of spectators were injured. Brookins himself, although thrown flat upon the ground from a height of 50 feet, was not seriously injured, his chief disfigurement being that sustained by most aviators sooner or later, viz., a broken nose. He expects to be flying again before the end of the meet, which terminates on the 20th inst.

On the same day upon which Brookins was injured, a German aviator named Heim fell from a height of over 200 feet at the Johannisthal Aviation Ground, near Berlin. He, too, was using a Wright biplane when, according to the cable report, one of the propellers broke and wrecked the machine. The aviator was gravely injured, and there is doubt as to whether he will recover. Aviator Dorner, in his German-built monoplane, made a five-minute flight, carrying a weight of 377 pounds, on the same day, while a Wright machine, driven by Herr Thelen, two days later, carried a dead weight of 462 pounds. The aviator, Weinczlers, made a sudden landing with his Antoinette monoplane while carrying a passenger and wrecked the machine, although neither he nor the passenger was injured.

At the Lanark Aviation Meet in Scotland last week Cattaneo, on a Blériot monoplane, made a new British record for a long-distance flight by covering 141 miles at an average speed of 44.16 miles an hour. In addition to this record and the height record made by Drexel, mentioned above, Robert Loraine, the American actor, made a magnificent flight in his Farman biplane, from Blackpool, England, to a point near Llandudno, on the north coast of Wales. From this point he again set out for Holyhead, at 5:30 P. M. He passed Orme's Head at high speed, heading in the direction of the Isle of Man. He finally alighted at Camlyn, on the north of Anglesey. His failure to reach Holyhead was due to the fog. This flight of about 50 miles across the Irish Sea is probably the longest straightaway flight over water up to the present time. Loraine found the fog a great hindrance.

The first long distance cross-country aeroplane race of any account to be held in France started on the 7th inst. over a circuit aggregating 485 miles, and divided into five stages. The first of these, from Paris to Troyes (135 kilometers, or 83 miles), was covered successfully by six of the eight machines entered. Le Blanc, on a Blériot monoplane, made the fastest time (1:33:20) averaging 53.93 miles an hour, while Aubrun, in a similar machine, was only 4 minutes and 5 seconds longer. The other successful competitors were Lindpainter, Weymann and Legagneux, who used biplanes. MM. Gregi and Bussan failed to finish, the latter's machine being wrecked in a cornfield. The second stage of the race extended from Troyes to Nancy—102½ miles. This was also won by Le Blanc, who was, however, closely pressed by Aubrun. Le Blanc's time was 2 hours 14 minutes and 59 seconds, an average speed of 45.56 miles an hour. Aubrun was only half a minute longer in covering the distance. Legagneux covered the entire distance also without making a descent, but his time was somewhat slower.

The third stage of the cross-country race from Nancy to Mezieres was also won by Le Blanc, who covered the 99.36 miles in 1 hour, 58 minutes, 3 seconds. Aubrun finally completed this stage two hours after Le Blanc. Lindpainter abandoned the race 12 miles from Nancy. Le Blanc had great luck in getting away just ahead of a heavy rainstorm. All the other aviators were caught in this storm, and most of them were forced to alight because of it. Several military aeroplanes followed the racers although they were not allowed to compete. One of these, carrying General Maumoury as a passenger, was lost in the storm and finally came down at Metz in Germany, from which point the flight back to Nancy was made. The success of this series of cross-country flights has demonstrated the practicability of the aeroplane as a rapid means of transportation. No doubt, within a couple of months, we shall have a similar demonstration in America.

IMPRESSIONS OF FABRIC ON LEAD BULLETS

BY THE GERMAN CORRESPONDENT OF THE SCIENTIFIC AMERICAN

Dr. V. Balthazard recently communicated to the Paris Academy of Sciences a method of studying the impressions made by textile fabrics upon leaden bullets which have penetrated those fabrics. From these impressions conclusions of great value in criminal jurisprudence can be drawn.

Until this method was devised the task of experts was confined to proving whether a bullet found in the body of the victim of a crime had been discharged from the weapon belonging to the accused. Balthazard pointed out that a very obvious diagnostic had been overlooked. In a certain case he had to determine whether two pistol bullets which had been found upon the floor of the room, respectively one day and three weeks after the commission of the crime, had really struck the victim. Both bullets, owing to their small power of penetration, had merely inflicted slight wounds on the arm, without penetrating the clothing. On examining the bullets, Balthazard found distinct impressions of a woven fabric. Then he cut a piece from the sleeve of the victim's coat, stretched it on a smooth board and fired a lead bullet through it. On this bullet an impression was found which corresponded so exactly with the impression borne by the bullet found on the floor three weeks after the commission of the crime as to leave no doubt that the latter bullet had struck the victim. From a long series of experiments Balthazard obtained a great mass of data, upon which he based a method of investigation that appears to be entirely free from objection.

Every leaden bullet which has struck a woven fabric bears an impression of the threads, which is recognizable even when the bullet has perforated the clothing and penetrated deeply into the body, and is only obliterated, partially or entirely, when the bullet has been flattened by striking a bone or a metallic object. In order to obtain impressions for comparison with the impression found on a suspected bullet, a piece of the fabric is stretched over a smooth board and fired at with bullets similar to the bullet found, if possible with the weapon which the criminal is supposed to have used.

The accompanying illustrations show photographic enlargements of a very fine and a very coarse shirting, and of bullets which were discharged against them from a .28 caliber revolver, from a distance of about 15 feet. The finer fabric, a very tightly woven linen of the variety known as batiste, contains 100 threads to the inch. On close examination of the photograph of the bullet, it will be observed that the impressions made by the threads parallel to the axis of the bullet are lighter than the impressions for the transverse threads. This effect is partly due to the illumination, as the transverse threads cast sharper shadows than the others. Balthazard has proved, however, that there is a recognizable difference between the impressions made by the heavy warp and the lighter filling. This difference is of great importance in the case of certain fabrics. For example, the heavy warp of a cheap cotton velvet, although it lay at the back of the fabric, was impressed very distinctly upon the leaden bullet, while the woof and the soft velvet filling left scarcely a trace. In a garment composed of layers of different fabrics, such as a collar, cuff or shirt bosom, it is possible, with sufficient enlargement, to distinguish the impressions made by the different layers. If the victim has been struck by several bullets, it is possible to determine the garment through which each bullet has penetrated, or the character of the garments worn, even if these garments have been removed or destroyed for the purpose of effacing all trace of the crime.

One of our illustrations shows a coarse homespun shirting such as is worn by German peasants, which is characterized by great differences in the thickness of the threads. In consequence of this structure, the impression on the bullet shows very heavy and irregular lines. The deeper impression of the threads of the warp is well marked in this case. This bullet was also fired from a .28 caliber revolver from a distance of 15 feet.

Dr. Balthazard purposed publishing the results of his investigation in the form of a great album, which

will include the impressions made upon various projectiles by a great variety of fabrics, and will therefore offer material for comparison with the impressions obtained in any criminal case.

Recent Stellar Researches.

Kapetyn and De Sitter have deduced the parallaxes and proper motions of more than 3,000 stars from photographs made at Helsingfors by Donner. Each part of the sky was photographed twice, at an interval of 7 or 8 years, on the same plate, which was not developed until after the second exposure. Recent enumerations of stars of various magnitude appear to indicate that the star density decreases at great distances, but this apparent decrease may be due to absorption of light. The latter view is confirmed by the comparatively small amount of absorption observed in the spectra of stars of great proper motion. Turner believes it possible to estimate the distances of faint stars from their colors alone. If, however, absorption in interstellar space is neglected, the color indicates the temperature. Nordmann proposes a new temperature classification of stars based on photometric comparisons with Polaris, employing successively a red and a blue screen. Sikhoff attains an equivalent result by comparing the exposures required to produce equal photographic effects with two screens of different colors.

At Oxford, 40 pairs of photographs made at an interval of 15 years, and showing 10,000 faint stars, have been measured, but very few proper motions exceeding 20 seconds per century have been detected.

Herzsprung has found evidence connecting Sirius with the five stars of the Great Bear, which are known to be moving in parallel paths, with a common velocity, relative to the sun, of 11½ miles per second.

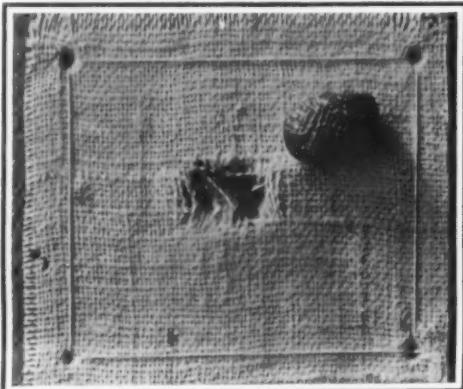
The two drift hypothesis has received additional support from the spectroscopic determinations, made by Hough and Halm at the Cape of Good Hope, of the radial velocities of 318 southern stars. In this region one of the opposing streams shows a marked preponderance, which is not manifested in northern stars. From the annual variations of 7 stars observed at the Cape, the solar parallax was computed with a precision little inferior to that of the value obtained from observations of Eros.

Astbury has discovered a new variable star of the Algol type. Van der Bilt and Campbell have studied U. Geminorum and S. S. Cygni, two variables of unusual type, with sudden increase and slow diminution of brightness, and maxima alternately long and short (20 and 12 days).

Major MacMahon has proposed to deduce the angular diameters of stars from the time required for their occultation by the moon, which can be measured by photographic methods. The Royal Astronomical Society, however, has concluded that irradiation and diffraction would destroy the value of the method.

The eighth volume of the publications of the Lick Observatory, issued in 1909, contains a fine series of heliogravures, representing the principal nebulae and star clusters of the northern hemisphere, from photographs made by Keeler with the Crossley reflector.

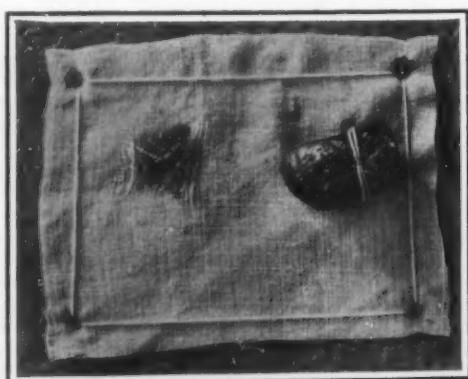
The Duluth, Mesabi and Northern is believed to be the greatest iron ore carrying railway in the world. It delivered to its enormous dock system at West Duluth last season, ore to the amount of 13,500,000 tons. This traffic was in addition to a heavy freight and passenger business. Its total main line mileage is 242, of which 82 miles is double tracked. The maximum south-bound gradient against the loads is 0.3 per cent. The maximum north-bound gradient against the empties is 2 per cent, this extending only six miles from the ore docks to the south end of the classification yards at Proctor. The entire main line, with the exception of a small part of the Biwabik branch, is laid with 80-pound steel rails, as are many of the spurs. The balance of the tracks is equipped with 60-pound rails.



A COARSE HOMESPUN SHIRTING AND ITS IMPRINT ON A LEADEN BULLET.



FIRING BULLETS AT FABRICS TO OBTAIN IMPRINTS OF THE THREADS.



A FINE BATISTE AND ITS IMPRINT ON A LEADEN BULLET.

A GASOLINE MOTOR-DRIVEN TILE DITCHER

BY FRANK C. PERKINS



HAIN type tile ditchers of novel form, and operated by gasoline motors, are being used for the purpose of increasing the value of land from 4 to 8 times by providing an improved means of drainage. They are of powerful construction and found to be great labor-saving devices. Farmers having wet land which is too water soaked to sow early enough to raise a crop that will mature and ripen, find that this is not worth much per acre, 320 acres of such land being valued at say \$8,000, or \$25 per acre. If the same wet lands are ditched and tiled they will easily be worth four times as much, or \$100 per acre, making \$32,000, or a conservative increase in actual value of \$24,000.

It is maintained that tile can be laid automatically more accurately to grade with a ditcher of the type shown in the illustration and driven by an internal combustion motor than in any other way. It has been demonstrated that the expense of tiling by machine, counting interest on investment, depreciation, cost of labor, gasoline and repairs, is less than one-third of the cost of tiling by hand.

It is of interest to note that a traction machine will propel itself, pull the ditcher and run the shovels that dig, in a bog, marsh or slough, with water "knee deep."

The working force required to operate the apparatus includes one man in charge of the machine, another to raise and lower the wheel and to steer the tractor, and a laborer to keep the tile spout filled. The guaranteed capacity for a depth of 10 feet is about 50 feet an hour; for a 7-foot depth about 100 feet an hour, while for a depth of 4 feet the rate of advance is 150 feet an hour.

This traction ditcher is equipped with a 20-horsepower double cylinder, heavy duty gasoline engine, and it is so mounted that it propels the tractor, pulls the ditcher, and furnishes the power for digging the ditch.

The unique traction machine being run by a gasoline engine, eliminates the use of a capstan and horses to haul the fuel. It lays tile 4 inches to 12 inches automatically (by gravity) so that if any dirt falls back, it must fall directly on top of the tile.

An interesting feature is an automatic cleaning device for use in cleaning the stickiest kind of mud from each of the various kinds of shovels, and the steel apron or conveyor.

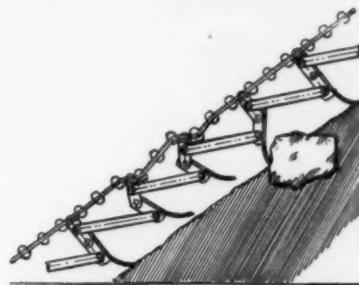
It will be noted that the tile is laid by gravity and a shield prevents the sides falling in till after the tile is laid. The bottom of the shield is curved, and is adjustable up and down so as to be always at the angle as the ditch and the tile.

Where tiling of a larger width than one foot is needed, a double-wheel machine is used having a chain that cuts a ditch from 12 to 24 inches. It is not practical on account of the weight, automatically to lay tile wider than 12 inches. It may be stated that the double-wheel machine is equipped with a sufficiently large gasoline engine to drive the tractor, pull the ditcher and run the shovels. It is further claimed that the principle of the machine is such that the toughest sod, slough-grass or roots are handled with ease, and the tile being laid automatically by the machine allows ground to be ditched and tiled that would be absolutely impossible to tile by hand.

This ditcher is arranged on skids one foot wide by 22 feet long, and is designed for use in ditching in the most swampy kind of bogs and lowlands. It will be seen that the conveyor is a steel plate apron

fastened to a link chain running over four sprockets having a cleaning device as above mentioned to scrape off any sticky mud that will not fall off. It is adjustable so as to carry off the dirt excavated at different distances, according to the width and depth of the ditch dug. The weight of the ditcher is about 4,000 pounds and the weight of the traction equipment with the 20-horse-power engine, including water and gasoline tank, is about 4,000 pounds.

The traction equipment is so geared that it can be used to move from one job to another and pull



Showing action when shovels strike big stones, roots, ledges or frost.

the ditcher mounted on wheels much faster and cheaper than by any other method, thereby making the machine practical for small as well as for large jobs. It is of interest to note that this labor-saving device digs different widths of ditch for different diameters of tile, and digs any depth up to 13 feet deep, while the grade or angle can be surveyed and proved before the tile is covered.

The grade stakes are left intact, and work easily may be proven before the tile is covered. It is possible to raise and lower each side of the frame, so

esting testimony before the Committee of Patents of the House of Representatives, in which he threw a flood of light on what it costs a great corporation to defend its patent rights. Mr. Dyer remarked that the cost of litigating a patent in this country is almost beyond belief, and in contrast to the simple, orderly, and effective system of the British courts, our practice stands as a triumph of complexity and red tape.

He stated that the litigation of the Edison lamp through all of its ramifications cost \$2,000,000 before the patent was finally sustained. Then a new defense was raised, alleging that the invention was made by Gobel. The Gobel defense was threshed out for several years at an additional expense of \$500,000, and was finally overthrown a short time before the patent expired. During practically the entire life of the Edison lamp patent, notwithstanding the most strenuous efforts to bring the suits to a close, infringers with impunity were profiting by the invention, and the patentee was powerless to stop them. By reason of additional difficulties in recovering damages and profits in patent suits, Mr. Edison to this day has recovered not a cent from the infringers who appropriated his property. Even now \$100,000 a year is spent by Mr. Edison in litigating patents and in trying to sustain them in connection with his company.

Mr. Dyer contrasted this case with an English one picked up at random, namely, the Flour Oxidizing Company (Limited) v. Hutchinson. In Mr. Dyer's opinion, if that case had been tried in this country it would have taken from five to ten years. It actually occupied twenty-two days in March and April, 1909. The action was commenced on May 27th, 1908, and the actual trial began on March 17th, 1909, ten months afterward. On the *prima facie* case, there were counsel's opening arguments, and seven witnesses were examined, six of whom were experts. The defendant's case comprised counsel's argument, and thirty-two witnesses were examined, five of whom were experts. On the rebuttal case nine witnesses were examined, six of whom were experts. The final arguments for defendant were made by two lawyers, and replying arguments were then made for the patent. The case was decided on the same day by the judge, and his opinion occupied fifteen printed pages. The judge was present all the time, had the opportunity of examining the witnesses, seeing how they conducted themselves, and of making up his mind whether they were honest or otherwise, and becoming

thoroughly familiar with the case, so that he could decide it almost the moment evidence was all in.

According to the Engineering Record, artesian wells are used to water about 2,194,674 acres of grazing land in Australia, and the watering of a further area of 380,960 acres by artesian bores has been undertaken. In addition, a number of private bores have been sunk, so that approximately 3,000,000 acres will be permanently watered. Many of the rivers of New South Wales, according to the last annual report of the Department of Public Works of that State, are simply drainage channels running through flat country, flowing after heavy rains and dwindling to a chain of water holes during periods of severe drought. Graziers in some instances excavated tanks to catch a rain water supply for their stock, but this method of storage was not always successful. Dams were also built across some of the creeks, but owing to the friability of the soil the surplus water soon cut other channels and additional dams had to be made. The ground water supply, according to the report, lies in some places 3,000 feet to 4,000 feet below the surface.



The tile ditcher operating in a marsh.

that the cutting wheel is always vertical and there is no "under cutting," and no tendency to deviate from the true grade.

What It Cost to Uphold the Edison Electric Light Patents.

Mr. Frank L. Dyer, well known as a patent lawyer representing Mr. Thomas Edison and the various Edison companies for a number of years, as well as the president and the chief executive officer of the various Edison companies, recently gave some inter-

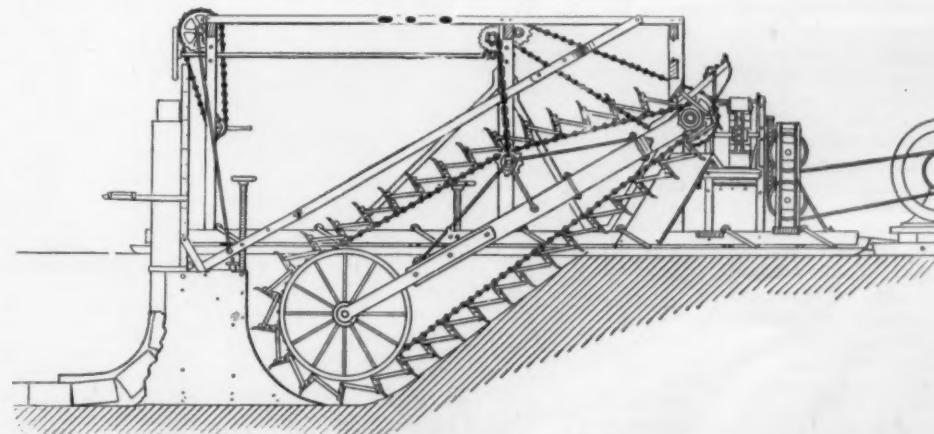


Diagram of tile ditcher, showing cutting operation of chain. At extreme left, tile is laid from curved shield.

A GASOLINE MOTOR-DRIVEN TILE DITCHER.

RAISING THE "MAINE."

The appropriation by Congress of \$300,000 for the raising the wreck of the "Maine" in Havana Harbor, and the opinion rendered by the Acting Attorney-General that it is the duty of the Secretary of War to undertake the work, make it certain that, if the task is within the compass of modern engineering, the wreck of the ship will be raised, and the entombed bodies of the sailors, who were lost over a dozen years ago, will be given honorable burial in the National Cemetery at Arlington.

On the front page of this issue we illustrate a practical method by which it is proposed to do this work. The plan was worked out by John F. O'Rourke, president of the O'Rourke Engineering Construction Company, who has submitted the proposal to Acting Secretary of War Oliver in a letter which describes fully the method by which the work would be done.

Briefly stated, the plan contemplates the building of heavy pile wharves along each side of the wreck and the sinking between the wharves and the ship of pneumatic caissons. Heavy steel cables would be slung underneath the ship's bottom, and, by means of powerful jacks carried upon the caissons, the wreck would be lifted clear of the water.

If the O'Rourke method be adopted the first operation will be to construct, parallel with the sides of the ship and about twenty feet therefrom, two ordinary pile wharves. Then, in the space between the wharves and the ship, twelve pneumatic caissons, of which there will be six on each side, will be sunk by the ordinary methods to a depth of about ten feet below the bottom of the "Maine." At every four feet along the caissons will be erected a stout A-frame, strongly braced and guyed, with double columns, which will be built up about thirty feet, and will be finished at the top with a massive casting carrying a screw jack of at least one hundred tons capacity. At each pair of opposite frames will be a pair of steel cables of different sizes, the cables on one side being of about two hundred tons capacity, and the other, on the opposite framework, being a small three-quarter-inch hauling cable. These cables will be carried down outside the caissons and underneath their cutting edges, the ends being coiled in the air chambers before the sinking is begun.

After the caissons have been sunk to the required depth, a small pipe will be pushed horizontally through the mud from one air chamber to the one on the opposite side of the wreck. Through this pipe the end of the small cable will be passed to the opposite air chamber; after which the pipe will be pulled back into that air chamber over the end of the cable, leaving it lying exposed in the mud. The end of the big cable will then be attached to the hauling cable, and the former will be pulled out from under the cutting edge, and under and around the "Maine" to the top of the opposite caisson.

When this has been done, a series of plow steel cables, each of two hundred tons capacity, will have been passed entirely around the bottom of the Maine, with their ends carried up to the caissons on each side. The combined strength of the cables will be equal to carrying four times the weight of the battleship.

It should be mentioned that a strongly-braced floor will be built above the wharf piling, and carried entirely across the tops of the caissons, and that each series of caissons, with its accompanying wharf, will thus form a structure of great rigidity and large bearing capacity. The screws of the powerful jacks at the head of the framework end in an eyebar head, and clamps are provided to grip the cables, which are finished in two similar eyebar heads, which are pinned to the screws of the jacks by a 3½-inch pin of over one hundred tons capacity.

When the screw jacks have all been connected to the cables, a strong tension will be taken upon the latter by means of the jacks, and then an amount of water corresponding to the weight of the "Maine" will be pumped out from the cofferdams of the caissons. The buoyancy thus given to the caissons will prepare them to receive the weight of the "Maine" without imposing any additional weight on the mud bottom upon which the caissons rest. The latter are made of sufficient size and strength to contain 50 per cent more weight of water than the ship weighs, so that there is a margin of about 3,000 tons of water to draw upon, should it be required.

The caissons being now prepared for receiving the weight of the ship, the bottom of the ship will be loosened from the mud by means of the water jet, small pipes being driven down alongside and underneath the hull, through which water will be forced under pressure, destroying the snug contact between the mud and the hull (the so-called suction) and so putting the vessel in condition for the final lift. The first operation will be to manipulate the screws on the lower side of the vessel until she has been brought around to an even keel, and leveled up fore and aft. Then the screws on opposite sides will be slackened off in pairs, set down to their fullest extent, and reclamped

on the cables when everything will be ready for an upward lift of about ten feet. This operation of setting down the screws and lifting the ship will be repeated until the vessel has been lifted clear of the water.

The next step will be to build a strong platform or deck between the bottom of the ship and the water, thus providing a drydock of ample strength, which will afford facility for the examination and repair (if so determined upon) of the hull.

In speaking of his method, Mr. O'Rourke says: "The wharf building, the caisson sinking, the passing of pipes through air chambers, the placing of cables underneath and around the ship, the construction of the lifting structure, and the fitting and operation of the screw jacks are all operations well understood, easily carried out, and independent of any questions of depth of mud or condition of the ship. The mud, however deep, does not complicate the question or add materially to the cost; and should there be obstructions at any point preventing the passing of the cables, tunneling to and removal of the obstruction is a simple matter. Damages to the ship, however great, would not prevent its being brought up intact because of the distribution of the weight and the flexibility, contiguity, as well as rigidity, of the means employed."

With the ship thus placed upon a stable platform, not only would it be possible to recover the bodies of the men who perished in the disaster, but in all probability the cause of the explosion could be determined beyond all question of doubt.

**RULES GOVERNING THE COMPETITION FOR
THE \$15,000 PRIZE OFFERED BY**

MR. EDWIN GOULD.

1. A prize of \$15,000 has been offered by Mr. Edwin Gould for the most perfect and practicable heavier-than-air flying machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate motors and propellers), so connected that any power plant may be operated independently, or that they may be used together.

CONDITIONS OF ENTRY.

2. Competitors for the prize must file with the Contest Committee complete drawings and specifications of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Such entry should be addressed to the Contest Committee of the GOULD-SCIENTIFIC AMERICAN Prize, 361 Broadway, New York city. Each contestant, in formally entering his machine, must specify its type (monoplane, biplane, helicopter, etc.), give its principal dimensions, the number and sizes of its motors and propellers, its horsepower, fuel-carrying capacity, and the nature of its steering and controlling devices.

3. Entries must be received at the office of the SCIENTIFIC AMERICAN on or before June 1st, 1911. Contests will take place July 4th, 1911, and following days. At least two machines must be entered in the contest or the prize will not be awarded.

CONTEST COMMITTEE.

4. The committee will consist of a representative of the SCIENTIFIC AMERICAN, a representative of the Aero Club of America, and the representative of some technical institute. This committee shall pass upon the practicability and efficiency of all the machines entered in competition, and they shall also act as judges in determining which machine has made the best flights and complied with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

CONDITIONS OF THE TEST.

5. Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and propeller independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be allowed to compete unless it can fulfill these requirements to the satisfaction of the Contest Committee. The prize shall not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight alternately and together. Recording tachometers attached to the motors can probably be used to prove such performance.

In the judging of the performances of the various machines, the questions of stability, ease of control, and safety will also be taken into consideration by the judges. The machine best fulfilling these conditions shall be awarded the prize.

6. All heavier-than-air machines of any type what-

ever—airplanes, helicopters, ornithopters, etc.—shall be entitled to compete for the prize, but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition.

7. The flights will be made under reasonable conditions of weather. The judges will, at their discretion, order the flights to begin at any time they may see fit, provided they consider the weather conditions sufficiently favorable.

8. No entry fee will be charged, but the contestant must pay for the transportation of his machine to and from the field of trial.

9. The place of holding the trial shall be determined by the Contest Committee, and the location of such place of trial shall be announced on or about June 1st, 1911.

The Freezing of an Orange.

On the night of December 29th last, when a severe cold wave swept over the South, Civil Engineer Merriweather, an orange grower of Winter Park, Florida, made a series of experiments to determine the effect of the cold on oranges. Through a small hole, made in the rind of an orange hanging upon a tree, he inserted a thermometer, forcing the bulb into the pulp. The rind fitted closely about the stem of the instrument. At periods of an hour he read the thermometer, finding that at 9 o'clock it registered 43 deg.; at 10, 40 deg.; at 11, 37 deg.; and at 12, 35 deg. At midnight he suspended another thermometer near the orange, in order to observe the outside temperature as well, and the following results were obtained:

Immersed		Free		Immersed		Free	
Time.	Bulb.	Bulb.	Bulb.	Time.	Bulb.	Bulb.	Bulb.
12:00	25	32	5:30	26	24		
12:30	33	31	6:00	30	23		
1:00	32	30	6:30	30	23		
1:30	32	29	7:00	30	24		
2:00	31	29	7:30	30	25		
2:30	30	28	8:00	30	27		
3:00	29	27	8:30	30	30		
3:30	29	27	9:00	30	32		
4:00	28	26	10:00	30	35		
4:30	28	26	11:00	32	38		
5:00	27	25	12:00	40	40		

It is interesting to notice that from 5:30 to 6:30, when the temperature of the outside atmosphere was going down, the temperature of the orange was rising, a phenomenon that is very puzzling and difficult to account for.

The Current Supplement.

The Kingdom of Roumania has a very limited coastline with no natural harbor of any importance; hence, the effort to create an artificial harbor at Constantza. This elaborate undertaking has very recently been completed, and is described at length in the leading article of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1807. This number also contains a very interesting account of the work done by Prof. R. W. Wood in photographing the moon in ultra-violet light, by which method he has discovered a vast deposit of some material quite different in composition from the rest of the lunar surface around one of the craters. "What We Know About the Earth" is the subject of an interesting article by E. Weichert. Under the title, "The Art of Discovery," Wilhelm Ostwald tells us how by means of systematic methods discoveries may almost be made by rule. Since the disaster which befell the Zeppelin airship at Ueckeritz, Capt. Fuchs has designed a peculiar folding anchor for airships, which is described in this SUPPLEMENT. The articles on the Development of the Steam Turbine, and Light and Electromagnetism are continued.

Wanted: Information About Dishonest Patent Schemes.

The SCIENTIFIC AMERICAN has always made a practice of exposing the snares and devices of the patent promoter, as well as the fraudulent patent attorney. Although the subject is by no means new to the readers of the SCIENTIFIC AMERICAN, it is one of which all inventors should be thoroughly informed. The Editor of the SCIENTIFIC AMERICAN would like to receive from readers of this journal, letters in which they narrate their personal experiences with dishonest promoters and attorneys. Such letters will be published in due course, and should not only be of interest in themselves, but should serve as a warning, thereby protecting others against such snares.

Kinetic energy is the power stored in a moving object which keeps it in motion. By way of illustration, conceive a railway train rushing along a straight, level stretch of track, the train being driven to its power limit. If the source of power, say the steam pressure, is now suddenly removed by closing the throttle, the train will continue to run or "coast," for a long distance due to its kinetic energy, gradually reducing in speed until the energy is exhausted and the train stops.

AN AUTOBIOGRAPHY OF AN ARTESIAN WELL.
RECORDED BY DR. SCHUYLER SKAATS WHEELER.

I am an old well of 270 feet, in the hill country near New York. On account of my reputation for purity, constancy, and always keeping a cool head, I was greatly respected in the neighborhood until within the last few years, when improvements on the estate where I belong have allowed demands to be made upon me that are beyond my strength. However, this has all brought me a great deal more attention.

I pass by, as hardly worth mentioning, the peculiar experiences when they used to pump me with a hot-air engine, which when left forgotten, would pump me dry and then get hot, for lack of cooling water, and so break down.

When the day of improvements came I was not allowed to be behind the times, but was equipped with the latest style of gasoline machinery, quite in harmony with the craze for automobiles and motor boats; but the same tendency for improvement made them want to know more about me, so they put a little air pipe down in me, and measured my varying depths by pumping in air with a bicycle pump. Sufficient air was pumped into the air pipe to prevent water from backing up into it, in this way the pressure of the air was always maintained equal to that of the water. When I was full, the height of water in me created pressure, which would be indicated by a pressure gage attached to the air tube above ground. When I was empty, the gage would show it by indicating zero pressure. In this manner the pressure gage always showed the height of the water. This arrangement was not very satisfactory because my water always swallowed up some of the air, and I never could tell my story except when there was some one at the top working the air pump.

But now they have given me a complete writing apparatus, by which I can tell my own story whenever I want to. It consists of a metal bulb that I can squeeze, put down in me to the very bottom, where I can always reach it, filled with water, and connected by a little tube to a pen above ground filled with ink and so arranged that by squeezing the bulb I can move the pen. A clockwork there is set to move a sheet of paper, so that the paper is always ready for me to write on, and it moves as I write.

While I can now tell my own story, my freedom is limited to answering questions like a witness. I can only tell such parts of my story as fit into the questions that may be asked me, and, therefore, depend upon the choice of questions my friends make.

When I saw my new writing pen, I was almost sure what the first question would be, and it came just as I expected: "How rapidly can you fill up if you start empty?" and the diagram shows my answer as I wrote it.

They were so pleased with the firmness and clearness of my penmanship, and the bold and clear way in which I wrote the answer, that they let me have my first autograph. The cross bars, like rungs of a ladder, represent steps upward, 10 feet each, and the upward bars the hours of the day. You can see that I wrote 80 feet in the first hour and then more slowly, and at the end of the third day a very slight rise.

The next question was: "If we pump steadily, how long can you hold out, and will you go down steadily?"

I was glad of this question, because it gave me my first opportunity to call their attention to my two water-bearing strata.

I showed that I subsided steadily down to 90 feet, but there I kept them busy for some time without having to move. Finally having to subside again, I did so rapidly down to 25 feet, where I kept them busy for over an hour without budging. Then I was all in. The explanation of this action was that at each of the stopping places that I wrote about, there was located a sort of sand-filled subterranean reservoir, which had to be pumped out before the level of the water in the well could sink again. This reservoir could not have been there unless there was an underground stream feeding it. So the hesitation in my writing in each case indicated a separate water-bearing stratum.

Then they tried pumping very, very slowly, and I told them that when they only pumped 1 gallon a minute I could supply it at a height of 125 feet, if 2 gallons, 100 feet; 3 or 4 gallons, 80 feet, and anything more than that at only 20 feet.

I shall be able to tell them more interesting things as soon as I have time. This morning I let them know that when full I am equal in height with the pond down the hill a quarter of a mile away, and I am going to tell them of the minerals I get out of the earth that the pond doesn't get, and that when they pump slowly the proportions of the minerals will be a little different from the proportions when they pump fast.

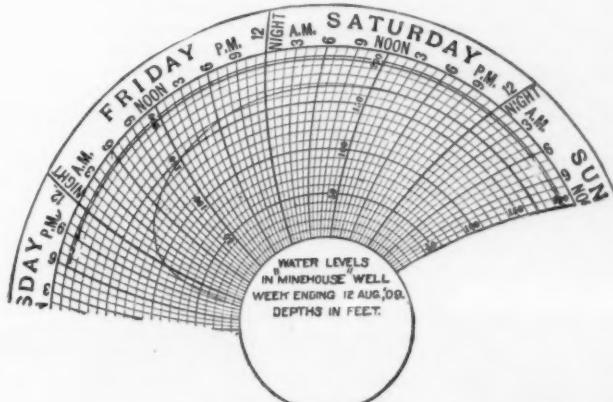
I know that he likes me because he comes to see me

nearly every day after he gets home, particularly if there is anything new, to see how I like it, but she never comes, although I think she has been invited. I know he likes me, too, on account of many little things he has done that are for my good, and which no one could know how to do, unless he had thought about my side of things a great deal.

Some time ago, when the great well expert, whose name I do not remember, but it was hard to pronounce softly, who is the father of most of the wells in this neighborhood, was over to give me a bath and put me in order generally, and accidentally dropped a big iron drill in me, he made an awful row about it, and after they had fished for two days in me to recover it, he made them stop, because he said the constant probing would be more irritating than to leave the drill.

He defends me, too, and when others say I am not much good and will not be able to supply the place, he argues that I am not understood and not treated right, and that he is satisfied that if I am handled in a way that is suited to my temperament, I will do so much that it will surprise my detractors.

I think he is going to win out, and I will tell you why. From the particular questions he has asked me, and also from scraps of conversation with the local plumber that I have heard, I believe I can see something of the way his mind is working. He knows that my constitution will not stand sudden, severe pumping for a short time. This is the way the water supply for nearly all houses is obtained, but it always gets me "winded" quickly. I think he is going to change the whole construction of the machinery to suit me, so that my pump, instead of running a short time and violently, will run a much longer time, in fact, will



FIRST AUTOGRAPH OF THE OLD WELL.

run always, never stopping, and will pump very gently. This will give me the advantage of an easy and soothing motion instead of a violent and irritating one, and will give him the advantage of getting water always from the highest level that I am capable of furnishing it at in that quantity.

In other words, out of consideration for me, and to enable me to do my best, he will no longer pump to suit the tank, starting when it is empty, pumping very hard, and stopping when it is full, and then leave me idle, as this treatment is too severe for me. Instead he will run the pump to suit me, that is slowly and all the time.

White Phosphorous in Match Making.

Investigation of fifteen American match factories during the year 1909 has proved that, in spite of modern methods and precautions, phosphorus poisoning in the most serious form occurs in the United States. Numerous cases of phosphorus poisoning were discovered by special agents of the Bureau of Labor who visited the factories, and it was learned that many other cases had occurred. There is no doubt that in some instances the employers have been in ignorance of the serious dangers of match-factory employment. In several factories visited, not a single notice was posted warning the employees of the peculiar dangers to which they were exposed. The United States is practically the only commercial country of any importance which has not taken any steps to prevent the unrestricted use of white phosphorus in the manufacture of matches. While several States have enacted laws prohibiting the employment of children under sixteen years of age in certain operations in match factories, no State has yet made any adequate provision for the protection of the health of workers over sixteen years of age in the match industry.

To Cement Iron to Wood or Stone.—(a) Over a coal fire mix together 4 parts black pitch, 1 part wax and 1 part brick dust; (b) 4 parts black pitch, 1 part each sulphur, iron filings or bricks dust.

Correspondence.

A SUGGESTION TO AVIATORS.

To the Editor of the SCIENTIFIC AMERICAN:

The addition of a very simple device by means of which the adjustment of the carburetor of an aeroplane motor may be varied from the operator's seat, will contribute greatly to the reliability of the machine and prevent or remedy in many cases the missing and annoying loss of power to which these motors are subject.

Such a device is even more desirable upon an aeroplane motor than upon an automobile owing to the fact that the former is subjected to more widely varying atmospheric conditions due to altitude, varying air strata and topography. It does not partake of the nature of a complication, but rather of a necessary accessory, is easily constructed and seems to me should be incorporated in every aeroplane.

WM. D. BELL.

Wheelerburg, Ohio.

ABOUT SULPHURIC ACID BURNS.

To the Editor of the SCIENTIFIC AMERICAN:

I have read often of horrible burns by sulphuric acid and was especially shocked by the accident recently in Philadelphia, where some children riding on a truck were seriously burned by the breaking of two carboys of the acid which were being carted on the same wagon.

Just remember that plain water, lots of it, must be poured on the victim of a sulphuric acid accident at once, even to throwing the party into the water if possible. This acid on the skin feels like fire.

With water quickly applied in great quantity, this acid is rendered harmless. I have been burned with it repeatedly without harm, through a knowledge of this proper antidote.

If not treated promptly the most horrible disfigurements result. The police department in Paris exhibit wax figures of faces of victims of the foreign practice of throwing this acid in one's face. A prompt treatment of water would have rendered the acid harmless.

A few years ago a man in my employ carrying a pitcher of this acid stumbled and spilled some on his clothing. In less than a minute the cloth touched by the acid was completely decomposed, and the man stood there with his trousers almost burned off. While we were laughing at him he said "my feet hurt." We immediately removed his shoes and found that some of the acid which had penetrated them burned the stockings to a pulp. A prompt application with our garden hose removed all the acid and the man was absolutely uninjured by the otherwise serious accident.

Just remember, for sulphuric acid, the antidote, "lots of water." This should be known generally, as the acid is commonly used everywhere, and while of great usefulness, is always dangerous.

Utica, N. Y.

JULES DOUX.

MECHANIPULATE.

To the Editor of the SCIENTIFIC AMERICAN:

The word manipulate contains two root-words: "Manus," the hand, and "pulus," the wrist. This verb, it seems, does not suit Mr. Wood's purpose, doubtless because it contains the root "manus;" but the other root "pulus" does not appear to trouble him for he introduces it into his newly coined word "mechanipulate."

I agree with Mr. R. W. Springer in the opinion that "to operate upon" is amply expressive; but if this be not considered sufficiently succinct and some new word must be found, perhaps "mechanoperate" might find acceptance.

SUTHERLAND MACKLL.

Geneva, N. Y.

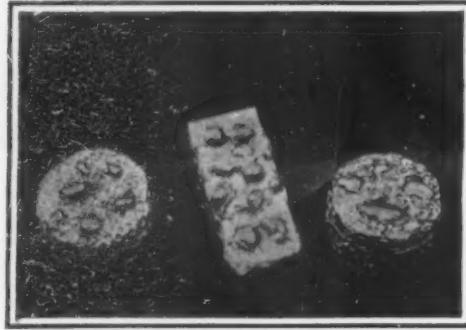
A structural steel contract of unusual magnitude, equaling that of the largest bridges, is to be placed by the Isthmian Canal Commission. It is for the manufacture, delivery and erection of about 58,000 tons of steel for the 46 gates of the Gatun, Pedro Miguel and Miraflores locks. These gates are from 47 feet 4 inches to 82 feet high and are constructed of steel throughout. Some idea of the magnitude of the work involved in them can be gained from the fact that if the 92 leaves could be piled one on top of the other they would make a tower 1.2 miles high. Figures of such magnitude in respect to steel work are equaled by the latest reports from the Isthmus regarding other features of the work. The total excavation for March was 3,067,479 cubic yards, place measurement.—American Machinist.

ARTISTIC WAX WORK

BY MONICA BASTIN

In all the finer branches of artistic handiwork, originality, precision and a certain deftness of fingers are indispensable to striking success. With these and with the necessary foundation of talent, it is possible to turn the artistic sense (even moderately possessed) to very good account.

Among the novel, and possibly the least exercised of such crafts, may be classed that of mosaic making with sealing wax. Although the idea is not quite unknown, yet it is not often carried out to its fullest



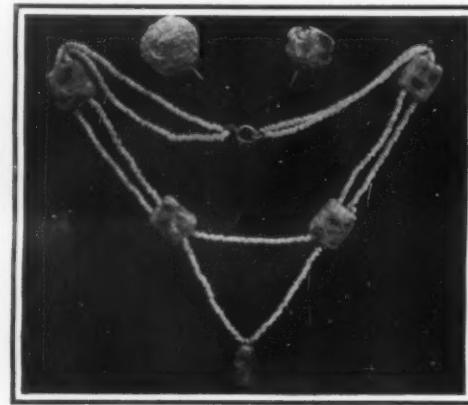
Little pin or trinket boxes.

extent. Not only mosaic jewelry may be taken as a pattern, but many kinds of metal work can be effectively copied. Added to this there are plenty of original schemes to be devised with the many shaded wax alone.

The first articles attempted by the novice may be the colored beads of various shapes and sizes so often threaded into bracelets and necklaces. The foundation of these beads is made with cork, one-eighth of an inch thick. The cutting of the cork is not very easy to an inexperienced hand. The best thing to use is an old, very sharp table knife, inserted with a sort of sweeping movement that will give a clean unjagged edge. The knife will probably require sharpening after every few cuts. The finishing touches should be made with the small blade of a sharp penknife. The sections should be cut rather smaller than is intended for the size of the finished beads. Having thus prepared a center on which to work, take an old hatpin, and stick the cork firmly on the end of it. Select a piece of sealing-wax of the principal color required for the bead, melt it over a clear flame, and cover one side of the cork at a time, allowing this to harden before the other is treated. Now remove the bead from the pin and see that both ends are properly covered. Each bead must be solid and well shaped. Any little irregularities can be smoothed over by slightly reheating the wax in the flame. The

gum and hang them to dry. Then thread them after any fashion selected, interspersed with colored glass or metallic beads. The finishing touch is added by varnishing them with a picture copal varnish. This will take about two days to harden in a warm atmosphere before the beads are ready to wear.

The molding of hatpin heads may now be con-



A necklace made with sealing wax slabs and beads. Also two hat pinheads.

sidered. From a plain, many-colored sphere to the most elaborate style which a large hatpin makes possible, there is an endless variety of design at one's disposal. The shape can be made over the round head of an ordinary hatpin. If, however, it is to be flat or after the fashion of a coin, it must be molded like the beads, over cork. In the latter case, the glass head can be broken away with a hammer, and the piece of cork of the required shape and size substituted. A very pretty rainbow effect can be obtained by dropping patches of colored wax on the bead, until a rough circle is made, and then holding it close to the flame, turning it rapidly so that the colors run together. Continue this until the surface is quite smooth and glossy, and until the circle is regular. Then let the wax dry for a minute away from the flame, still turning the pin round and round, so that it may not drop one side more than another. Finish it off by dipping it first into gum Arabic and then varnishing it after the same process used when making the beads.

Yet another direction in which artistic wax work can be employed is in the imitation of beaten metal articles. Gold and silver bronze of exact tint suitable can easily be obtained for this purpose. Any small boxes or trays will do for covering, though if they be of tin or some smooth material, the surface should be slightly roughened by rubbing over with

as if they were inset with precious stones, such as turquoise, by dropping wax of the right shade in little lumps on the surface of the box before the metal is applied. Let these harden, and then surround them with the gold or silver wax in such a manner that they stand up rather above the finished surface of the box.

Another rather novel method of ornamentation is carried out with odd shaped pieces of colored glass. They are placed at fairly regular intervals on the



Piercing a bead with a hatpin.

article to be adorned. The spaces in between are then filled up with smooth strips of sealing wax, carefully laid so that the edges of the glass are completely concealed.

BONDS OF REINFORCED CONCRETE.

Boats were first constructed of reinforced concrete by Gabellini in Rome. They have been described in these columns. Concrete boats are now made in Germany. In April, 1910, a scow intended for use in dredging and similar work was launched in Pomerania. The boat is 33 feet long and 13 feet wide, and has a capacity of 22.5 tons. It consists of four watertight compartments. The end compartments are decked and serve only as air chambers, while the middle compartments are open at the top and can be used for the reception of cargo. The total depth of the boat is about 4½ feet; its weight is 17 tons, and its draft when unloaded is 20 inches. It is constructed like an iron or wooden vessel, of transverse frames, longitudinal beams, and plates. The plates are about 3 inches thick. The frames and beams are 5 x 10 inches. The bulwark is stiffened between the frames by a plate 8 inches high and 1½ inches thick, to which are attached oaken buffers extending entirely around the vessel. According to the Engineering News, scows made of reinforced concrete are also



Stamping out the boxes in imitation of beaten metal.



Cutting the cork sections for the foundation of beads.

ARTISTIC WAX WORK.

bead can be decorated with spangled or metal wax according to individual taste, any device being carefully picked out in tiny drops of wax, and then melted on to the background by again holding the bead close to the flame. When this is done, and the bead is of course quite cold and firm, heat a hatpin and pierce one or more holes through to the other side of the slab, and in the right position according to the design of the finished article of jewelry. This must be done with the greatest caution, or all the previous work will be spoilt. The holes, if not clean and carefully made at the opening, may block again with the half-melted wax. When the required number of beads are finished, thread them on a piece of wire and dip them one by one into gum Arabic sufficiently thick to coat each well. Wipe off any superfluous

sand paper before putting on the wax. Cardboard pill boxes will make pretty little pin cases. The inside and the edges can be brushed over with gold paint in order to hide all traces of the card. The sealing-wax is first dropped on the box, and before it hardens, pressed with fingers previously dipped in cold water, until it is thinly spread. Then another patch is dropped and spread in like manner, and so on, until the whole of the box is covered. The wax is softened again by holding a lighted match or taper close to it. It is then dented all over in little circles with a piece of wood rounded at the end. This is only one method of decoration. Landscapes or designs of flowers can be worked out with wooden instruments shaped according to the requirement of the various strokes. The boxes can be made to look

to be used in the dredging operations of the Panama canal. One of these scows is already launched. It weighs, complete, 27 tons and has a draft of 4 feet.

At the old Eidsfoss iron mines, which were worked in the eighteenth and nineteenth centuries in connection with the ironworks of the same name, trials have been carried on for the last two years with the intention of reopening the mines. Prof. Vogt reports that the expectations have been fulfilled in respect to the quantity of ore present, as well as to the quality. With the view of ascertaining whether the ore might be suitable for mechanical separation, experiments have been carried out at the laboratory of the University at Christiania, which have shown very satisfactory results.



Covering a box with metal wax.

SANDS THAT IMPRISON SHIPS

BY JAMES G. McCURDY

The stretches of sand lying directly north and south of the mouth of the Columbia River, while possessing but few of the topographical characteristics popularly associated with the regulation "Marine Cemetery," have nevertheless for years taken heavy toll from the commerce visiting this section.

North Beach, to the north, and Clatsop Beach, to the south, are beautiful specimens of shore line, free from hidden reef and treacherous tides. No inhospitable shores lie in wait to crush the timbers of staunch ships, but on the contrary, gentle eminences studded with summer cottages front the sea.

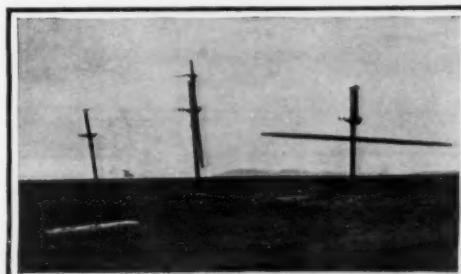
The real danger to shipping lies in the frequent muffling fogs, and the peculiar consistency of the sand which holds with a tenacious grip, and speedily swallows every object thrown upon its surface. Even the drift which litters the ordinary beach for years, here speedily becomes engulfed within the depths of the sucking sand.

The masters of incoming vessels, seeking the entrance to the Columbia River and prevented from obtaining a reckoning by reason of long-continued fogs, are often kept in ignorance of the proximity of the land until their ships have thrust their prows into the sandy shore. The mariner unacquainted with the locality generally feels no great alarm at the accident.

His vessel, practically uninjured, is so near land that the crew can in many cases walk ashore dry shod at low tide. He confidently expects by the use of a kedge anchor or the services of a tug-boat, to get afloat at the next high water.

ships have met disaster within a single month. Yet, owing to the peculiar conditions prevailing already noted, but few of these wrecks have resulted in loss of life.

As may be surmised, the wreckers have made use of every device known to the profession, such as coffer-dams, centrifugal pumps, winches and tug-boats,



British ship wrecked on sands in 1883. Another wreck in the distance.

in their efforts to effect the release of the numerous vessels that have become imprisoned in these clinging quicksands, but up to the present time much of their work has gone for nothing.

The tides rush in far enough to wash back the sand as fast as it can be removed, but are not of sufficient rise to permit the use of pontoons or other devices for the floating of the great unwieldy hulls. Fre-

stood for \$500, and the "Galena" brought but a trifle more.

Not more than half a mile from where the "Peter Iredale" occupies her last resting place, is to be seen an object which at a distance appears to be a cross. A closer inspection proves it to be a yard swung horizontally across the iron forecastle of the ship "Cairnsmore," which went ashore in 1883 while endeavoring to enter the Columbia River, after having successfully fought her way around Cape Horn, laden with a cargo of cement from Europe.

The cross in reality marks a grave, for 75 feet beneath the surface lies the hull of the doomed ship. The hull is steadily sinking and in a few more years will be obliterated, even this memorial the ill-fated craft has placed over her sepulchre.

One of the very few vessels to be salved on the North Beach was the Columbia River Lightship No. 50. This vessel, after remaining in the sand over two years, was with infinite labor loosed from her spongy bed, incased in crib-work and pulled with engines upon solid earth. She was then taken over a mile across a narrow neck of land and launched in deep water in a bay in the rear of the spot where she had come to grief.

This was in the spring of 1901, and a full account of this novel salvage feat appeared in the SCIENTIFIC AMERICAN at that time.

◆◆◆

The Sense of Color in Fishes and Invertebrates.

The name phototropism has been given to a certain reaction to light which is exhibited by many animals



Practically uninjured, this four-masted is doomed to sink in the sucking sand.



Wreck on Clatsop sand beach, Oregon, dismantled by wreckers.

He speedily realizes his error. Within a few hours his vessel has begun digging her grave in the yielding quicksands and the chances are one to a hundred that his ship has found her last resting place.

The inhabitants hereabouts have a saying that no vessel ever floats again after striking the North Beach and Clatsop Sands, and while there have been some few exceptions to this broad statement, fortunate indeed is the craft that figures in this latter class.

Probably the first vessel to strike these sands was the famous "Bees-Wax Ship," so called on account of the bees-wax, candles and tapers that have been found buried in the sand near the mouth of the Nehalem River. This ship is believed to have been the Spanish vessel "San Jose," which left La Paz, Lower California, in the summer of 1769 with a quantity of mission supplies for the Catholic Mission at San Diego.

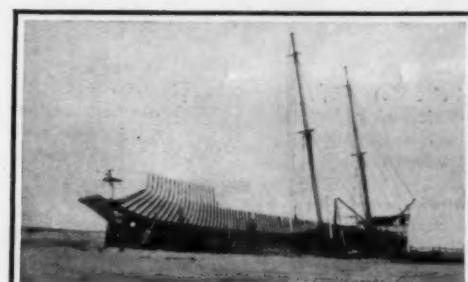
The vessel was probably driven far north of her destination by a storm and met her fate in the Oregon sands, as she was never heard of after leaving port. The fact that some of the bees-wax recovered from the beach is stamped with Latin inscriptions strengthens the belief that the Nehalem wreck and the ship "San Jose" were one and the same. According to the Indian accounts the entire crew reached shore in safety, but were afterward massacred by the natives.

The founding of Astoria in 1811 by John Jacob Astor, had a tendency to attract shipping to the Northwest, and before many years a large fleet of vessels was engaged in the carrying trade in and out of the Columbia River. From this fleet the treacherous sands early began to levy tribute, which has continued to the present time without diminution, in spite of the installation of many safeguards for the prevention of shipwreck.

Seldom has a year passed without a wreck occurring along this stretch of ocean beach. As many as four

quently, when success has been all but attained, some unforeseen contingency has arisen to rob the wreckers of their well-earned reward.

In the majority of cases, the best that can be done is to strip the stranded vessel of everything removable and to tear the hull in pieces for the sake of the metal. Often the wrecks are battered to pieces by the surf, or become so deeply buried, that even this dismemberment is not possible.



A British bark wrecked on North Beach sands, broken up by wreckers.

SANDS THAT IMPRISON SHIPS.

The latest additions to this ship's graveyard were the "Galena" and "Peter Iredale," fine four-masted barks which came to grief within the past year, and which, although practically uninjured at the time of taking the sands, were fated never to return to their proper element.

Both of these vessels are being salved piecemeal by the wreckers. The "Peter Iredale" was bought as she

and plants. The phototropism is called positive when the organism is attracted by light, and negative when it is repelled. In many cases, even in the animal kingdom, there is no true perception of color, or even of light. The phototropism is due to the general sensitivity of the skin and subjacent tissues to luminous and thermal radiations.

The numerous experiments of Hess on vision in animals show that the question of color perception is a very delicate one, and cast doubt upon published statements of the discrimination of colors by lower animals. According to Hess, young sprats seek the yellow-green region of the spectrum, not because they have a predilection for that color, but simply because this region is the brightest part of the spectrum. These fishes appear to be affected also by violet, but not at all by red. Blennies and some other fishes fail to perceive bits of meat illuminated by red light. The curve of color sensitivity in fishes bears a striking resemblance to that of a person entirely color blind. The boneless lancelet (*Amphioxus*), the lowest of the vertebrates, is likewise most affected by the yellow-green part of the spectrum. Water fleas and other small crustaceans, lice of butterflies and mites, etc., show very similar reactions. Water fleas, like fishes, assemble in the green and yellow green part of the spectrum, but move to any other region, blue, violet or red, if this is illuminated more brightly than the yellow-green.

It is reported that plans are under consideration by the Boston and Maine Railway for the elimination of coal and oil-burning locomotives in the Hoosac tunnel in Massachusetts. Should the change be made, a power plant will be established near South Adams, the tunnel will be lighted and ventilated by means of electricity, and only electrical engines will be used to draw the trains through the tunnel.

ELECTRIC CLOCKS

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

During the past few years considerable ingenuity has been displayed by inventors in the attempt to apply electric drive to timepieces. The quest is a fascinating one, inasmuch as it has long been realized that such a means would dispense with the necessity of winding up the mainspring or weight at intervals of a few days, and would at the same time bring about a perceptible simplification of the internal mechanism with a smoother working. Up to the present, electricity in connection with horological work has been confined mostly to the operation, from a central point, of a number of other clocks or dials throughout a building, so as to secure absolute synchronism of time throughout the various departments. Recently, however, the subject has revived in interest and one or two varied methods of actuating a timepiece on this method have been introduced. In nearly every instance complete success has been baffled by one apparently insuperable difficulty—the natural exhaustion of the cell or accumulator for the supply of the necessary energy. The clock when fitted with a new cell, and accordingly adjusted to work at that pitch, ran smoothly and evenly for a period, keeping excellent time, but as the battery began to give out lost its regularity in corresponding ratio, and thus becoming unreliable, was discarded.

One inventor has, however, achieved complete success in this direction. This is Mr. Murday, of the Reason Manufacturing Company of Brighton, and the types shown in the accompanying illustrations represent the result of many years' close study and experiment. Two styles have been evolved, one working on the ordinary pendulum principle, the other on the balance wheel lines. In both instances there is a marked reduction in the number of wheels necessary to transmit the motion to the face hands, and similarly either can be driven by a small dry cell, while each is quite self-contained.

The pendulum clock can fulfill any of the requirements demanded by such timepieces, and can be applied to the ordinary grandfather's clock which forms a conspicuous embellishing feature of entrance halls, to the small clock standing on a bracket or chimney piece, or be of use as a master clock for driving a number of distant dials with equal facility and regularity. The general mechanism of this clock can be gathered from the accompanying illustrations, which show the dial removed and the movement withdrawn from its case respectively. In order to secure greater reliability and a longer life without attention, two dry cells are used to furnish the electric energy, held firmly in clips on either side of the movement in the upper part of the case as shown. The clock has a half-second movement, and as will be seen, the wheel train is very simple, and is mounted on the front face of a single plate. The motion, together with the cells, is carried on a single shelf and the whole can be withdrawn intact from the case after detaching the pendulum.

In another illustration the back view of the movement is shown with the cells removed. Extending vertically in the center is the crutch to which the pendulum is attached, and by means of which the oscillating motion of the latter is transmitted to the wheel train. At the upper end it is pivoted in a bracket, while near the center of its length is a projecting arm carrying the wire clicks. As the crutch, together with the pendulum, swings to-and-fro, these clicks move the click wheel round, by an ingenious alternate pull and push movement. It will be seen that the click wheel, instead of being toothed, has its periphery divided into four cams in succession. While the engaging end of one wire catches the notch and pulls the wheel, the other likewise engages with the opposite notch and pushes it round.

The lower end of the crutch carries the usual horizontal fork in which the pendulum rod is hung. The extremity of the crutch also carries a small thin tongue of steel known as a "toggle." This tongue is fashioned to swing in either direction, and as the pendulum swings to and fro it sweeps over a small brass block carried on the upper surface of a long flat spring, set transversely to the crutch. One end of this spring is fixed in a stud, while the opposite extremity, which is free, is faced with platinum and plays between a platinum tipped contact screw and a binding screw above it. The brass block mounted on this spring has three slight grooves on its top face.

The central one is somewhat deeper than the others, which are placed toward the ends of the block, and allows the toggle to hang freely in the vertical position when the clock is stopped. The other grooves not being so deep cause the toggle, when it engages with either, to exert a downward pressure upon the spring. When the pendulum is set swinging the arc described is sufficient to sweep the toggle off the brass block on either side, but as the arc is decreased, until at last the toggle cannot pass off the block, it becomes tripped in one of the two end grooves al-

to the shelf and the inside of the case, so that no elaborate operation is necessary when the batteries are renewed.

The balance wheel clock is a more ornamental timepiece, and somewhat recalls the 400-day clock, where-in the horizontally oscillating heavy pendulum is suspended by a fine hair spring. In this case the pendulum comprises merely a fairly heavy wheel, which drives the wheel train, instead of vice versa, as in a spring driven watch or clock. Above this wheel is a giant controlling spring, together with a regulator, which performs exactly the same function as the hairspring of a watch. In this case the object of the electric drive is to impart renewed impetus periodically to the balance wheel, the impulses being given when the arc of oscillation falls to a fixed minimum.

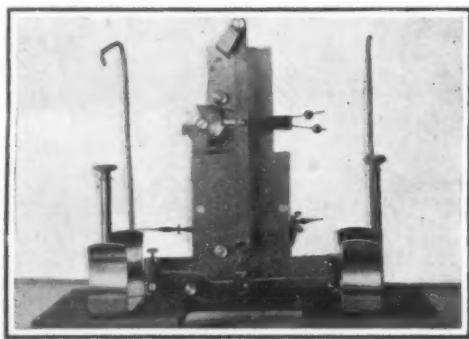
In the majority of clocks working on these lines, notably in that which runs for 400 days without winding, the arc of oscillation is comparatively small, but in the Murday clock the balance wheel more than completes a total revolution, which insures sufficient momentum being imparted to the wheel at an impulse to keep it vibrating for some time. The clock is invariably adjusted to receive a fresh electrical impulse every two minutes or so, but this factor fluctuates somewhat according to the condition and strength of the battery. Fundamentally the principle is exactly the same as that described for the operation of the pendulum, the balance wheel carrying a toggle which sweeps over a flat spring carrying the brass contact block. When the arc of the wheel's oscillation drops down to the predetermined point, the toggle trips in, the brass block depresses the contact spring, closes the electrical circuit, and energizes an electro magnet and armature which give the wheel a fresh boost to keep it going for about two minutes, when the same cycle of operation is repeated until at last the battery becomes exhausted. As in the pendulum clock, working on this intermittent principle, accuracy of the timepiece is quite independent of the variation in the battery power, at any rate, until the latter is almost worn out, and the development of inaccuracy, probably at the end of two years or so, indicates that fresh batteries are required.

The balance wheel is not affected by changes in temperature as it is made of a special nickel steel alloy. This enables complicated construction of a compensated wheel rim to be avoided. The hardened steel pivots of the balance wheel staff, or arbor, run in large sapphire cups, so that friction is practically non-existent. A roller attached to the upper part of the staff and acting upon a lever operates the wheel train at every oscillation of the balance wheel. This action is strikingly safe, steady and smooth, while it insures almost complete silence. The two dry cells are carried in the wooden base upon which the clock is mounted, thus being out of sight, but are easily and quickly accessible. The motion being visible with the transparent rim glass dial, the clock has a handsome appearance.

The prolonged tests that have been made with these timepieces under a great variety of conditions have served to demonstrate their reliability and efficient all-round time-keeping qualities. In the case of the balance wheel type, should the wheel stop, from some unforeseen circumstance, such as might inadvertently occur in handling, the toggle rests in a neutral position, keeping the electrical circuit broken. In one type of electric clock when such a stoppage happens, the circuit is closed, and the battery is run

down without fulfilling any useful service. The Murday clock is particularly useful in factories and buildings where heavy vibration may exist from passing traffic or running machinery, as the action is quite unaffected, and the time-keeping qualities are not influenced thereby. These features, combined with the dispensation of the frequent winding operation and the simplicity of the system, render the clock the most efficient electrical type that has yet been produced.

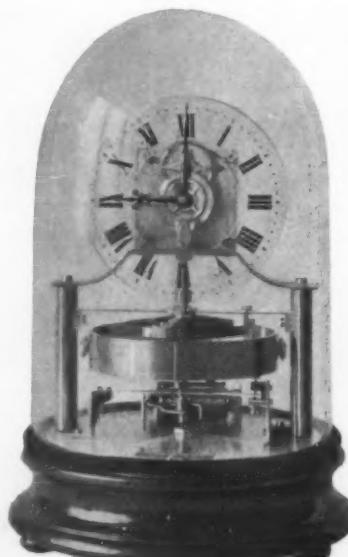
A liquid japan for leather is made as follows: Take four pounds of molasses, half a pound of lamp black, half a pound of sweet oil, and an equal quantity of gum arable, also half a pint of isinglass. Mix well in 16 pounds of water; apply heat, and when cool add one pint of alcohol.



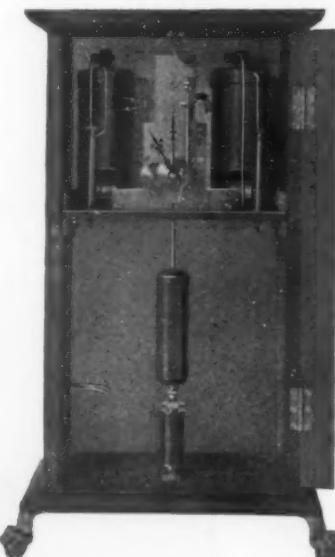
The motion of electric pendulum clock showing crutch "toggle" contact block and spring; also click wheel with push and pull motion.

ready mentioned, the contact spring on which the block is carried is forced downward, the electric circuit is established, and a small electromagnet is energized. This happens as the armature on the lower end of the pendulum shown in the illustration is approaching the magnet, centrally mounted in the bottom of the case, and the attraction exerted on the armature imparts a fresh impulse to the pendulum restoring the arc oscillating, which suffices once more to sweep the toggle right clear of the block. Each impulse thus given keeps the pendulum oscillating freely for another fifty or sixty swings.

The pendulum rod is of nickel steel, so that there



Balance wheel electric clock, showing wheel, large hair-spring above, contact spring, electro-magnet and wheel train.



Pendulum clock dial face removed, showing magnet and armature on pendulum; also simple train wheel system.

ELECTRIC CLOCKS.

is practically no variation of timekeeping due to climatic variations, and if the clock is properly set up and leveled in the first instance, it may be safely left untouched for months, since after adjustment, owing to the perfection of the electrical system, the variation will not amount to more than a second or two per week. The regulation of the clock itself is carried out on the usual lines by the manipulation of the pendulum bob. Two cells are ample to drive the clock, and these will suffice for a period of about two years. Renewal only entails an outlay of about 25 cents per cell. These are simply pressed well home into the spring clips on the motion shelf, and connected up to the terminals which establishes connection with the clock mechanism. By merely replacing the shelf the final electrical connections are effected, there being spring contact pieces attached

THE WORK OF THE SAND ARTIST

CLEVER SAND SCULPTURES AT SHORE RESORTS

With the passing of the sand artist, the tourists at one of our most popular seashore resorts are deprived of a pastime that has for some years proven a great attraction. One cannot help a feeling of regret that the "Sand Men" have been excluded from the broad beach, where their quaint, cleverly modeled groups have amused and interested many a passer-by, and even brought some small income to the workers.

It was usual to see several artists at work (even a few children among them), copying small pictures or plaques, or modeling from memory. The Lion of Lucerne was a favorite figure represented with variations, according to the artist's skill, or familiarity with the photos of the original. Lions seemed to be the most popular animals for sand sculpture, and in some instances have been so well executed as to closely resemble marble statuary. The automobile, which, with its occupants, for some time formed quite a center of interest, had a surprisingly realistic effect, and was a good example of the compactness and durability of sand work, under proper treatment. Reproductions of Thorwaldsen's "Seasons"—his famous scenes from peasant life, are perhaps the best illustrations of the possibilities of this unique medium, and were conspicuous among the most recent sand groups.

Putting New York's Fire Department on a Motor Basis.

BY H. T. WADE.

When the Fire Department of the city of New York, in connection with its high pressure service, adopted for one of its most important companies an automobile hose wagon, the SCIENTIFIC AMERICAN called attention to the possible effects that would follow the successful use of such a piece of apparatus. Not only increased speed and efficiency, but a marked economy of maintenance over horse-drawn apparatus were claimed, and much interest was expressed as to the behavior of a heavy motor vehicle under the severe conditions imposed in the fire service of the metropolis. To-day, largely as a result of the successful and constant use and thorough test of this hose tender for over a year and a half and in line with the present progressive tendency to raise the equipment of the New York Fire Department to the highest plane of efficiency, another step of even greater importance is being taken which points unmistakably to eventual reorganization on a motor basis and the gradual elimination of horse-drawn apparatus. Within a few weeks Fire Commissioner Waldo has prepared specifications for five large, standard, motor-driven, high-pressure hose wagons for the congested district of Manhattan, a slightly smaller hose wagon, also motor driven, probably for use in Brooklyn; a motor propelled combination hose wagon and pumping engine for the suburbs, an automobile aerial extension ladder truck, and two motor trucks of $1\frac{1}{2}$ tons capacity for general transportation. In addition there has been awarded a contract for the alteration of a second size Nott steam fire engine, so that in place of the usual front wheels there will be substituted an automobile chassis with a three-cylinder 90 horse-power gasoline engine. In other words, the only change from existing practice will be in the use of motor propulsion to replace the horses, there being no interference with the present boiler or pumps. Thus New York is about to enter upon the horseless age in its fire department, and the reasons for this seemingly radical departure, which is in reality a most carefully considered and premeditated scheme, are of great interest.

The new specifications contemplate apparatus that fundamentally must meet existing fire department conditions as regards strength, power and general efficiency, in addition to the more radical innovations and improvements that will contribute so much to its increased usefulness. Outside of rigorous efficiency tests for acceptance and a guarantee covering two

years of satisfactory service, the specifications are marked by an absence of special details, so that any automobile manufacturer, who has made at least twenty-five machines of standard type and can meet the peculiar requirements needed for fire apparatus, is at liberty to enter the competition.

Now it must be emphasized that this step is not being taken in answer to a mere demand for novelty or sensational speed, but solely for increased efficiency and economy. Thus it is estimated that in answering an alarm from a box at a distance of less than one

while the cost of forage, shoeing, veterinary attendance, etc., would amount to some \$900 annually. Accordingly with increased efficiency the annual saving in maintenance for three or four years would be sufficient to meet the difference in initial cost.

The functions and advantages of the motor-driven hose wagons are most obvious, and when completed they will give six companies in the high-pressure district this modern equipment. The lighter hose wagon is designed for use with the motor propelled steam fire engine, now under alteration, probably in the Borough of Brooklyn, and much interest will attach to the performance of the company to which this novel and complete motor equipment will be given. Likewise the new motor-driven aerial ladder truck will have an important function on the upper part of Manhattan, where the extension ladder plays an important part in fire fighting and life saving, especially in non-fire-proof apartment house fires. This truck is to have an electric motor on each wheel supplied from a generator driven by a gasoline engine and controlled by the driver. The success of this truck and of the fire engine chassis will doubtless lead to their further installation. The combination motor hose wagon and pumping engine presents another interesting problem. The new specifications demand a reciprocating or piston pump instead of a rotary pump, which though not as highly regarded by most fire engineers, is now the

more prevalent type on apparatus of this kind. The combination motor engine has already gained a foothold in the smaller cities and towns on account of its utility and low cost of maintenance, but the larger cities have been less ready to introduce it. To meet Commissioner Waldo's requirements and secure acceptance for the New York Department it must be capable of delivering 700 gallons of water a minute against a pressure of 120 pounds, or 420 gallons per minute against a net pressure of 200 pounds. The vehicle, with a load of 4,500 pounds, must be able to maintain a speed of 30 miles per hour, thus making it peculiarly suitable for high speed work in the suburbs. It is to carry scaling ladders and tools, and if all conditions are met, should prove a very useful piece of apparatus. The various classes of fire apparatus mentioned, for all of which manufacturers have evolved types which they believe can meet the specified requirements, are worthy of attention, which it is hoped can be given with some detail in future issues of the SCIENTIFIC AMERICAN.

A test of a reinforced concrete floor was made recently under very unusual conditions, including a fire test with the floor under load, the fire test apparently being required under the city's building ordinances. The structure was a ten-story office building, with floor panels 22 feet by 20 feet center to center of columns. The floors were designed for a working load of 100 pounds per square foot, and were required to stand a test load of 200 pounds per square foot with a deflection not exceeding $\frac{1}{8}$ inch. The deflection with this latter load on a test panel of the floor was only $\frac{1}{8}$ inch. The building inspector then had a fire test made of the loaded panel, and with a hot fire beneath the deflection increased by $1\frac{1}{4}$ inches. Water from a fire hose was then thrown upon the bottom of the heated slab, and the recovery was $\frac{1}{8}$ inch, leaving $\frac{1}{4}$ inch deflection. A small amount of concrete snalled off under the action of the stream of water. The building inspector considered the result unsatisfactory in leaving $\frac{1}{4}$ inch deflection, and the approval of the structure on behalf of the city is now in dispute. It is pointed out that the heated bars in the lower part of the slab may have taken a slight permanent set as the effect of the sudden cooling. While many fire tests on concrete slabs have been made in special test chambers, it is very unusual to require such a test in a completed building.



An example of the compactness and durability of sand sculpture.



The Lion of Lucerne done in sand.

THE WORK OF THE SAND ARTIST.

repairs, fuel, lubricating oil, etc., for a year amounted to \$50, and at the end of this time, despite the fact that it had answered every alarm to which it was called without a single failure, there was no loss in efficiency due to deterioration; a statement that can be explained at once by calling attention to the small amount of mileage traveled by fire apparatus in comparison with commercial or other automobile vehicles. This wagon, which is essentially the prototype of the five called for in the recent specifications, carries 45 lengths of heavy hose, a tool kit, and the usual engine company complement of eight or ten men. Now for the horse-drawn cart referred to above, there would be required three horses costing from \$320 to \$350 each, or \$1,000 for the team; and as the average useful life of a fire horse is but five years there would have to be written off each year for depreciation \$200,

RECENTLY PATENTED INVENTIONS.
Electrical Devices.

APPARATUS FOR OPERATING ELEVATORS.—C. NEWSON, Salt Lake City, Utah. The invention relates to electrically-operated elevators. The purpose is to provide a construction for a power-actuated apparatus, located in the hollow shaft for an elevator, which adapt a car connected therewith to traverse the hollow shaft in either direction with absolute safety, permit the car to be stopped at desired points, positively hold it stationary when purposely stopped, avoid shock thereto while moving or stopping and enable the operator to control speed of the car.

TEMPERATURE-INDICATING SYSTEM.—G. W. LEVENGOOD, Lebanon, Pa. An object here is to provide a device which may be located at the place at which the temperature is to be kept within certain limits so that the undue variation of the temperature, as in the case of fire, indication of such variation will be given at the central station. The operator at that station can determine whether or not the indication is caused by accidental disarrangement of circuit or whether it is really due to a decided change in temperature.

Of Interest to Farmers.

BROODER.—G. H. LEE, Omaha, Neb. This invention refers to brooders for raising young chickens and the like, and has reference more particularly to a device, comprising a casing and an adjustable hover adapted to be raised and lowered so that the chicks or other creatures in the brooder can be protected to a greater or less degree against temperature changes.

Of General Interest.

INDEX.—G. THACKRAH, Salt Lake City, Utah. This improvement has reference to bookkeeping, and its aim is to provide an index for use in indexing the names of persons, places, things, or words by the first and final letters thereof, the index being simple and easily manipulated and arranged to permit instant reference to an exceedingly large number of entries.

ORE-CRUSHER.—I. L. MITCHELL, Cedar Rapids, Iowa. In this instance practical provision is made to adjust the block on which the lower portion of the movable jaw is fulcrumed very quickly within a wide range, and means are provided for further adjusting such fulcrum block in order to set the movable jaw in exact position required. The means are strong and durable and adapted to be constructed at small cost.

WINDING DEVICE FOR LACES.—J. E. NACE, Hanover, Pa. This invention pertains to winding devices, the more particular purpose being to provide an improved type of hand-operated winder for use in connection with laces. It comprehends a hand winder adapted for winding lace upon a spool, and further, means for readily exchanging one spool for another.

LETTER-SLOT ATTACHMENT.—J. POPENHAUER, Chicago, Ill. More particularly the invention has in view the providing of means to close a slot made in a trunk or other receptacle through which letters may be disposed. The renter of a room when absent may rest assured that his letters will not be misplaced after they have been pushed through a slot by a servant.

UMBRELLA OR PARASOL.—M. PERELL, New York, N. Y. This improvement refers to self-opening umbrellas and parasols, and the object is to provide a new umbrella or parasol, arranged to insure self-opening on unlocking the closed umbrella, and to permit of closely rolling the umbrella at the time the operating parts are in a closed position.

LOG-GRAB HOOK.—H. JOHNS, Manhattan, Pa. The invention refers to tools used in lumber camps, and especially to hooks used in securing a series of logs together or where one or more logs may be drawn from the stump to the mill or to a convenient place for transportation. Means prevent likelihood of accidental displacement of the hook from the log.

APPARATUS FOR REFINING AND DESILVERIZING LEAD.—G. P. HULST, Omaha, Neb. The object in this invention is to provide an apparatus for use in refining and desilverizing lead bullion and impure lead, and whereby the number of crystallizing operations is reduced to a minimum, for the proper production of high grade bullion or metal running five hundred to six hundred ounces silver and a market lead.

CHUTE.—W. DREYER, Tomahawk, Wis. The invention is an improvement in chutes for cellars and similar places for passing coal, wood, vegetables, etc., and has in view a tubular chute of any suitable cross-sectional form having a door closing the chute at the outer end, the said door having a screened ventilating opening and provided with a relatively smaller door seating over the screen.

PORTABLE VULCANIZING APPARATUS.—M. BOUCHET, 22 Rue Alphonse de Neuville, Paris, France. This invention relates to an apparatus for heating at constant temperature and for a definite period of time, different articles and particularly articles made of India rubber, for the purpose of vulcanizing the same. For this operation the body treated

should be brought exactly to the temperature of 140 C. (284 F.) and the heating should last for a definite period of time.

PROCESS FOR MAKING FUEL-BRIQUETS.—E. BONSTEIN, Shickshinny, Pa. An object here is to manufacture a briquet which shall burn freely and give out good heat, but which shall be practically smokeless. A further object is to manufacture a briquet which will resist the weather when exposed to rain, snow, etc., and which will not disintegrate under these conditions.

CURRENT WATER-WHEEL.—G. A. HESSE, Wallace, Idaho. This improvement relates to a wheel adapted to be operated in a flowing stream or wherever there is sufficient current of water to generate power, to be used in any well known manner. An object is to provide means for deflecting the current to the water-wheel, so that a majority of the blades of the paddle will be exposed to the force of the current all the time.

EYEGLASS-MOUNT.—L. E. GRANT and E. A. WEGENER, Portage, Wis. The principal objects in this issuance are: To provide fastening devices for securing the lens in the mount for locking the fastening devices; and to provide a construction simple, durable, and efficient. The expandable screw used entirely removes all strains from the lens.

RECEIPTACLE.—O. J. WEEKS, New York, N. Y. More particularly the invention relates to a receptacle for ice cream and the like, fashioned from heavy paper, cardboard and other suitable material, and formed of blanks folded and glued, cemented or otherwise secured together, and having vessels connected at one extremity, the outer vessel being provided with a removable end wall at the other extremity.

FOLDING MUSIC-RACK.—V. SIMKINS, Agana, Island of Guam. The principal objects which the present invention has in view are: The provision of a structure which may be folded within a small compass to form a neat and compact parcel; and the provision of means for locking the various members in their folded and extended positions.

ILLUMINATING COMPOSITION.—F. C. SIMSON, Halifax, Nova Scotia, Canada. This invention relates to compositions which are self-luminous in the dark, the more particular purpose being to provide a composition offering superior advantages regarding the degree of light emitted and having suitable form to be used in a variety of relations where the use of illuminating compositions is ordinarily difficult or impossible.

FLOWER-STAND.—A. STIGLER, Gillepsieville, Ohio. The invention relates to stands for growing plants, flowers, or the like, and more particularly to a device having a body formed from an originally plastic material adapted to harden, such as plaster or concrete, the body comprising a base, a standard, and a bowl, and having a reinforcing member imbedded in the standard, and, further, a reinforcing basket embedded in the bowl and associated with the member.

POTTERY-KILN.—F. G. HANET, East Liverpool, Ohio. Among the principal objects which the present invention has in view are: To provide a kiln wherein the necessity for the employment of saggers or supporting devices is avoided; to provide a construction wherein the kiln may be adapted to be heated by either coal or gas; and to provide a construction and arrangement whereby the breakage caused by the removal of articles is diminished.

DETACHABLE PAD FOR SELF-INKING STAMPS.—T. H. COX, Newark, N. J. In this instance the improvement refers to inking pads used upon self-inking stamps, the inventor's more particular purpose being to provide an improved mounting for holding the pad in the stamp in such manner that the pad may be readily detached for purposes of charging it with ink.

ANCHORING-BASE FOR POSTS.—P. T. BAILEY, Newport, R. I. This invention relates more particularly to the means employed for securing the post to the base, whereby the post may be given the desired adjustment in respect to the base. An anchoring spike formed of sheet metal is employed, and to the upper end of this spike a clamping member is secured, and so constructed that a post may be directly secured there between or a substantially horizontal post supporting bar may be used.

Hardware and Tools.

LOCK.—H. C. STEVENS, Flemington, W. Va. This invention is an improvement in locks and especially in the class of hasp locks, such as are particularly adapted for use in fastening trunks, dress suit cases and the like. The lock is mortised or recessed into the trunk, and a stop shoulder is provided on the tubular hub to limit the inward movement of the knob.

PIPE-WRENCH.—P. E. ERICKSON, Port Chester, N. Y. The wrench is arranged to permit its convenient application to pipes of different sizes, and to insure a firm grip on the pipe without danger of slipping. For this purpose a chain is permanently attached at one end to a lever, fulcrumed eccentrically on a handle jaw, the other end of the chain being arranged for removable connection with the lever.

DOUBLE-DOOR LOCK.—A. M. HOMS, St. Paul, Neb. This invention provides a plural-

ity of locks for double doors which are controlled by a master lock; provides an upper and a lower retaining bolt and controlling mechanism therefor operated simultaneously and from the same point; and provides a construction whereby upper and lower bolts are centrally operable and controlled.

RESILIENT COMPOUND LEVER.—W. V. GILBERT, Vicar Company, Ltd., Kings Chambers, Portugal street, Kingsway, W. C., London, England. This invention refers to levers formed of spring material and having opposing members, and a back part connecting the lever arms, and being so constructed that when the back part is subjected to lateral compression applied to its ends the arms are caused to move in another direction, that is, recede from each other at their free ends, and when such part is released from pressure, the device resumes, or resiles, to its normal form or condition.

WIRE-SPLICER.—A. V. ANDERSON, Florence, Minn. This tool is suitable for winding the overlapping ends of the main wire, together with the third wire, about the oppositely extending portions of the main wire, the tool comprising a head having a main wire passage and a main wire and a third wire jaw oppositely arranged at the opposite sides of the passage, the jaws being preferably adjustable to and from each other to adapt the tool for wires of different gage.

Heating and Lighting.

LAMPLIGHTER.—C. A. HACKER, Fairhaven, Mass. This invention is an improvement in lamplighters, and the purpose of the inventor is to provide a device for use in igniting a round wick central draft oil lamp, with a spark, and to further provide mechanism whereby the electrical connection may be made with the lamp merely by setting the lamp on the stand.

Household Utilities.

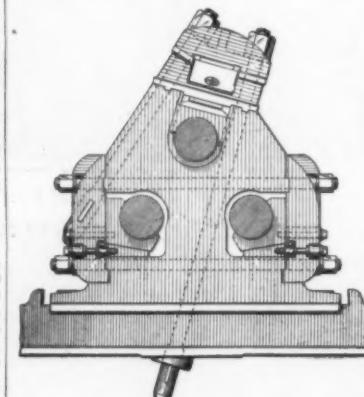
URINAL.—N. FROST, Bloomington, Ill. The invention relates to certain improvements in urinals, and more particularly to that type in which there is a substantially vertical back plate, to the upper edge of which water is delivered, and extending outwardly from which there are a plurality of partitions, divisions or screens, to separate the device into separate or individual stalls.

TOWEL HOLDER.—O. D. HAMMOND, Wyoming, N. Y. This holder is for use for holding towels or other cloths, and may be made of any suitable metallic wire, and can be nickel-plated or otherwise finished or coated as desired by manufacturer or purchaser. An important feature is that the weight of cloth and holder operates to draw the arms toward each other by the action of the loops upon their supporting device. These loops rest flatwise side by side and approximately in the plane of the body of the holder, and they slide upon each other in the plane of the body of the holder.

REFRIGERATOR.—N. HEYMANN, New Orleans, La. In this patent the invention has reference to improvements in refrigerators, and has for its object to provide a device of simple construction and one which will be efficient in service both for keeping cold various articles of food and keeping a supply of drinking water cold at the same time.

Machines and Mechanical Devices.

HOUSING FOR SUGAR MILLS.—W. G. HALL, care of Catton, Nell & Co., Ltd., Honolulu, Hawaii. Among the principal objects which the present invention has in view are: To provide hydraulic jacks for imposing and equalizing the pressure on the master roll of the sugar-cane crushing rolls; to provide a mounting for the said jacks whereby the inequalities of wear of the bearing brasses are



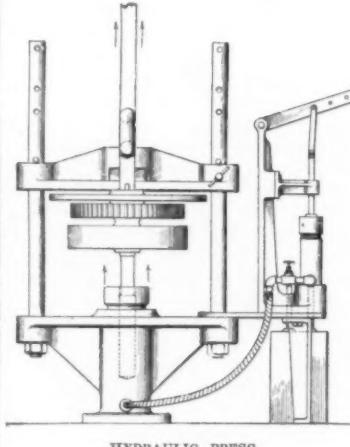
HOUSING FOR SUGAR MILLS.

accommodated; to provide devices whereby the said jacks may be withdrawn from operative position for repair or replacement rapidly and readily; to provide a bracing structure for maintaining the said master roll in position, the brasses being disposed with reference to receiving the maximum strain in a line coincident with the line of the resultant expansive

forces developed between the three rolls, and to provide means for adjusting the bearing saddles of the lower rolls.

PORTABLE SAFE FOR VALUABLES.—H. W. WOODRUFF, New Orleans, La. The improvement is in that class of portable safes provided for use of banks, express companies, and others having occasion to ship money, bonds, jewelry, and other valuables in a receptacle secured by locking mechanism. The consignee identifies the signature on the seal, as if on a check or draft, before receiving for the package.

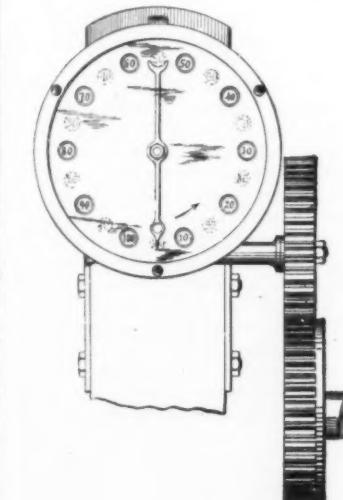
HYDRAULIC PRESS.—JOSEPH McD. GAMMELL and J. A. KIRBY, Spartanburg, S. C. This press is intended for use in forcing off gears and pulleys from defective loom crankshafts in cotton and woolen manufacturing plants, and also for forcing the pulleys on a new shaft. The base of the press is bored out to provide a cylinder in which is a plunger provided with a central spring-pressed pin. When removing the pulley, the plunger and



HYDRAULIC PRESS.

pin bear against the shaft, while a yoke holds the pulley down. The plunger is raised hydraulically. When applying a pulley to a shaft, the pin is removed from the plunger, and the shaft is pressed down into the pulley by means of the yoke, the lower end of the shaft extending into the bore formerly occupied by the pin.

ODOMETER.—JOHN J. STONE, care A. F. Crandall, Beresford, South Dakota. The object of the device here illustrated is to provide an odometer for engines and other motors and machines, which is arranged to indicate accurately the speed of a machine, and thus permit the attendant in charge to regulate the speed according to the work to be performed.



REVERSIBLE ODOMETER.

A novel feature of the instrument is the fact that it may be set to register with shafts running in either direction. The number plate of the machine is covered by a second plate provided with apertures to show only alternate numbers. One set of alternate numbers is arranged to read clockwise, and the other counter-clockwise, so that the cover plate may be adjusted to show either set of numbers.

GRINDING MACHINE.—D. E. PLAISTED, New York, N. Y. The aim in the present invention is to provide a new and improved high speed grinding machine for use in grinding cylindrical, toric, and other lenses with the greatest accuracy and in a comparatively short time, and without undue wear of the working parts of the machine.

ADJUSTABLE WORK SUPPORT AND GAGE FOR CHANNELING-MACHINES.—A. H. PRENZEL, Halifax, Pa. One of the purposes of this invention is to provide an ad-

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Scientific American Supplement 1544 contains an article by Lewis A. Hicks, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

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Scientific American Supplement 1574 discusses steel for reinforced concrete.

Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip L. Wormley, Jr., on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively describes the making of mortar and concrete, depositing of concrete, facing concrete, wood forms, concrete side-walks, details of construction of reinforced concrete posts.

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